NATURAL RESOURCES CONSERVATION SERVICE

VIRGINIA CONSERVATION PRACTICE STANDARD

WASTE STORAGE FACILITY

(No.)

Code 313

DEFINITION

A waste storage impoundment made by constructing an embankment and/or excavating a pit or dugout, or by fabricating a structure.

PURPOSE

To temporarily store wastes such as manure, dry poultry litter, wastewater, and contaminated runoff as a storage function component of an agricultural waste management system.

SCOPE

This standard establishes the minimum acceptable requirements for design, construction, and operation of waste storage facilities. This standard does not apply to Virginia Conservation Practice Standard *Waste Treatment Lagoon (Code 359)*. The Virginia Conservation Practice Standard *Composting Facility (Code 317)* shall be used for composting.

CONDITIONS WHERE PRACTICE APPLIES

The storage facility is a component of an approved agricultural waste management system plan that has been agreed to by the landowner/operator.

Temporary storage is needed for organic wastes generated by agricultural production or processing.

The storage facility can be constructed, operated and maintained without polluting air or water resources.

Soils, geology, and topography are suitable for construction of the facility.

One or more fabricated structures, such as tanks, stacking facilities, and pond appurtenances are needed.

The practice applies to facilities utilizing embankments with an effective height of 25 feet (7.7 m) or less where damage resulting from failure would be low hazard (Class a) and limited to damage of farm buildings, agricultural land, and country roads.

CRITERIA

GENERAL CRITERIA

Federal, State, and Local Laws

Waste storage facilities must be planned, designed, and constructed to meet all federal, state, and local laws and regulations. The owner or operator shall be responsible for securing all required permits or approvals and for performing in accordance with such laws and regulations. NRCS employees are not to assume responsibility for procuring permits, rights, or approvals or for enforcing laws and regulations, but may provide the landowner or operator with technical information needed to obtain the required rights, or approvals to construct, operate, and maintain the practice.

Location

Waste storage shall be located as close to the source as practical. To minimize the potential for contamination of streams, waste storage facilities should be located outside of floodplains. However, if site restrictions require location within a floodplain, they shall be protected from inundation or damage from a 100-year flood event. If required by laws, rules, and regulations, the structure shall be protected from storms greater than the 100-year flood event.

Waste storage facilities shall be located so the potential impacts from breach of embankment, accidental release, and liner failure are minimized; and separation distances are such that prevailing winds and landscape elements (building arrangement, landforms, vegetation, etc.) minimize odors and protect aesthetic values.

Waste storage facilities shall be located as far from neighboring dwellings or other areas of public use as practical and as required by federal, state, and local laws.

Table 1 lists the minimum distance requirements from public or private facilities. Local zoning ordinances may have other restrictions or setbacks that may be more restrictive. All state and local laws, ordinances, and regulations must be met in this design before construction of the facilities.

Table 1. Minimum Distance Requirement for Waste Storage Facilities

Public or Private Use Facilities	Minimum Distance From Waste Storage Facility
Any public use area, church, picnic area, playground, etc.	700 feet (215 m)
Residence or place of habitation other than owner or tenant	700 feet (215 m)
Potable Wells, Private	100 feet (30 m)
Potable Wells, Public	300 feet (90 m)
Natural Water Courses	200 feet (60 m)
Milking Parlor	100 feet (30 m)
Drainage Ditches	100 feet (30 m)
Area specified by state or local ordinance	Greater of state or local distance or distance shown above

Storage Period

The storage period is the maximum length of time anticipated between emptying events. The minimum storage period shall be 120 days or that storage needed to utilize waste in accordance with a current certified Nutrient Management Plan for the agricultural enterprise. Six months will normally be the optimal storage period based on the timing required for environmentally safe waste utilization considering the climate, crops, soil, equipment, and local, state, and federal regulations.

Design Storage Volume

The design storage volume equal to the required storage volume shall consist of the total of the following, as appropriate:

(a) Manure, wastewater, wasted feed, bedding, and other recoverable wastes accumulated during the storage period;

(b) Normal precipitation less evaporation on the surface area of the storage facility (at the design storage volume level during the storage period;

(c) Normal runoff from the facility's drainage area during the storage period. Non-polluted runoff normally should be minimized;

(d) 25-year, 24-hour precipitation on the surface of the facility (at the required design storage volume level);

(e) 25-year, 24-hour runoff from the facility's drainage area;

(f) Residual solids after liquids have been removed. A minimum of 6 inches (135 mm) shall be provided for structures, unless there are added provisions at the unloading location for more complete emptying; and

(g) Additional storage as may be required to meet management goals or regulatory requirements (**ex., EPA CAFO regulations**). Freeboard for waste storage facilities should be considered.

The depth added to the waste storage pond to contain the 25-year, 24-hour storm volume shall be a minimum of 1 foot (0.3 m).

Use of a Virginia NRCS approved storage sizing method will be required to properly size a waste facility.

Accumulated Solids Removal

Provision shall be made for periodic removal of accumulated solids to preserve storage capacity. The anticipated method for doing this must be considered in planning, particularly in determining the configuration of ponds and type of seal, if any. Solid/liquid separation of runoff or waste entering the facility may be considered to minimize the frequency of accumulated solids removal, and to facilitate pumping and spreading stored waste.

Inlet

Inlets shall be of any permanent type and shall be designed to resist corrosion, plugging, and freeze damage. Erosion protection shall be incorporated as necessary. Inlets from enclosed buildings shall be provided with a water-sealed trap and vent or similar devices to control gas entry into the buildings or other confined spaces.

Emptying Component

Some means of emptying the facility shall be provided. Gates, pipes, docks, wet wells, pumping platforms, retaining walls, and ramps are examples of structures that can be used. Outlets shall be designed to resist corrosion and plugging. No outlet shall automatically discharge from the required storage volume of the facility. Features to protect against erosion, tampering, and accidental release shall be incorporated as necessary.

Where agitators are used in ponds with liners, the propeller tip shall be a minimum of 3 feet (0.9 m) from the liner surface or the liner shall be protected by a concrete pad. Wheel blocks may be installed on the slope to prevent the agitator from accidentally reaching the pit bottom.

Waste removed from storage facilities shall be utilized in accordance with Virginia Conservation Practice Standards *Nutrient Management (Code 590)* or *Waste Utilization (Code 633)*.

Service Life and Durability

Storage facilities shall be planned, designed, and installed to provide a minimum service life of 10 years. Planning, design and construction shall ensure that the storage facility is sound and of durable materials commensurate with the anticipated service life, initial and replacement costs, maintenance and operation costs, and safety and environmental considerations.

Safety Provisions

Design shall include appropriate safety features to minimize the hazards of the facility. Entrance ramps shall be designed for safe entrance based on the type of equipment used. Ramps used to empty liquids should have a slope of 4 horizontal to 1 vertical, or flatter. Those used to empty slurry, semi-solid, or solid waste should have a slope of 10 horizontal to 1 vertical, or flatter, unless special traction surfaces are provided. Warning signs, fences, ladders, ropes, bars, rails, and other devices shall be provided, as appropriate, to ensure the safety of humans and livestock.

Ventilation and warning signs must be provided for covered waste holding structures, as necessary, to prevent explosion, poisoning, or asphyxiation. Pipelines shall be provided with a water-sealed trap and vent, or similar device, if there is a potential, based on design configuration, for gases to enter buildings or other confined spaces.

Uncovered fabricated structures for liquid or slurry waste with walls less than 5 feet (1.5 m) above ground surface and ponds shall be fenced and warning signs posted to prevent children and others from using them for other than their intended purpose.

Livestock shall be excluded from the storage facility.

Erosion Protection

Embankments and disturbed areas surrounding the facility shall be treated to control erosion.

Water Table

The seasonal high water table shall be determined either by long-term monitoring or by the presence of diagnostic soil redoximorphic features as identified during on-site investigations conducted by an individual trained in soil and water relationships. For the purposes of this standard, "seasonal high water table" refers to the upper limit of soil saturation with water during the wettest season, and can occur at any depth within the entire soil profile observed during an on-site soils investigation. The NRCS Field Book for Describing and Sampling Soils recognizes three types of seasonal high water tables: apparent, perched, and artesian.

If feasible, the seasonal high water table may be lowered by the use of an artificial drainage system. The drainage system shall be designed by a qualified individual.

Subsurface Investigations

A subsurface investigation is required for all waste storage facilities. Subsurface investigations shall be conducted by individuals trained in soil science, engineering, geology, or a related field.

The number and depth of test holes, pits, or borings will vary depending on the planned surface area and depth of the structure and the conditions encountered during the investigation such as the complexity of the soils, the depth to groundwater, and the presence or absence of seeps. At a minimum, there shall be one test hole, pit, or boring for each 5000 ft^2 (460 m^2) for the first 20,000 ft^2 (1,840 m^2) of planned storage facility surface area plus at least one test hole, pit, or boring for each additional 10,000 ft^2 (920 m^2). Each test hole, pit, or boring shall extend at least 2 feet (0.6 m) below the planned bottom of the structure. The log for each test hole, pit, or boring shall indicate the following:

- Existing ground surface elevation;
- A description of the soil material encountered using the Unified Soil Classification System;
- Depth to changes in the soil material encountered;
- Depth to any seeps encountered;
- Depth to high water (note method of determination: mottling, free water encountered, etc.); and
- Depth to bottom of test hole, pit, or boring.

The location and log information for all test holes, pits, and/or borings in or near the structure shall be shown on the construction drawings.

Depending on site conditions, the use of Ground Penetrating Radar, seismographs, or similar equipment may be necessary to complete the site investigation.

SPECIFIC CRITERIA FOR WASTE STORAGE PONDS

Hazard Classification

The area downstream of the embankment must be evaluated carefully to determine the impact a sudden breach of the proposed embankment would have on structural and environmental features and to public safety. This evaluation must consider all improvements and those improvements that may reasonably be expected to be made during the useful life of the structure. The results of this examination provides for the proper hazard approval classification of the embankment. Only NRCS hazard class (a) embankments are to be designed under this standard. See National Engineering Manual Part 520.21 for guidance concerning documentation of hazard class determination.

Soils and Foundation

A detailed soils investigation must be considered in each design with special attention to the water table depth and potential seepage problems.

Avoid sandy or gravelly soils and shallow soils over fractured or cavernous rock and seek soils of slow to moderate permeability, when possible.

Information and guidance on controlling seepage from waste storage ponds can be found in the Agricultural Waste Management Field Handbook (AWMFH), Chapter 7.

Design Bottom Elevation

The design bottom elevation of the waste storage pond shall be no lower than 2 feet (0.6 m) above the seasonal high water table unless features of special design are incorporated that address buoyant forces, pond seepage rate and non-encroachment of the water table by contaminants. The water table may be lowered by use of perimeter drains, if feasible, to meet this requirement.

The maximum operating level for waste storage ponds shall be the pond level that provides for the required volume less the volume contribution of precipitation and runoff from the 25-year, 24-hour storm event plus the volume allowance for residual solids after liquids have been removed.

Waste Pond Lining

Uncompacted self-sealing linings from native soil are not acceptable for waste containment. **All waste ponds shall be sealed or lined to achieve a permeability of 1 X 10^{-6} cm/sec (0.0028 feet/day) or less on all interior impoundment surfaces**. The liner subgrade shall be a dense base regardless of liner method. Liners shall be protected from puncture by adjacent fill materials and waste pond filling and pumping operations.

Soil liners should be avoided in karst areas. If soil liners are used in a karst area, a geologic site investigation shall be done to determine the potential for onsite sinkholes to develop. If a high risk is determined by the geologist or other qualified individual, a geomembrane or concrete liner shall be used.

The construction of piers, loading ramps, inlets, outlets, and other appurtenances must be accomplished in a manner that does not damage or impair the operation of the liner system. The construction area must be free of water.

The waste pond shall be sealed by one of the following methods:

1. Compacted Soil Liner

   Soil liner shall be a clay liner designed for a maximum permeability of 1 X 10^{-6} cm/sec (0.0028 feet/day) or less. The minimum soil liner thickness shall be one foot measured perpendicular to the completed holding pond bottom and side slopes.

   The liner soil shall be placed in layers not more than 9 inches (230 mm) thick prior to compaction and compacted to the density required to meet the specific discharge requirement. A minimum of 2 compacted layers is required. Moisture content before compaction shall be approximately 2 percent wet of optimum.

   Compaction requirements shall be verified as required by plans and specifications. The completed liner shall be tested and certified by an independent laboratory to verify a permeability equal to or less than the design value.

   Compacted earth liners shall have side slopes of 3 horizontal to 1 vertical (3:1), or flatter, except where compacted earth liners are part of (brought up with) an earthen fill operation. The compacted earthen fill liner shall be covered with not less than 1 foot of compacted material measured perpendicular to the finished surface.

2. Flexible Membrane

   A flexible membrane liner will be designed and constructed in accordance with Virginia Conservation Practice Standard *Pond Sealing or Lining, Flexible Membrane (Code 521A)*.

3. Bentonite Liner

   A bentonite liner will be designed and constructed in accordance with Virginia Conservation Practice Standard *Pond Sealing or Lining, Bentonite Treatment (Code 521C)*.

4. Concrete Liner

   A reinforced concrete liner may be used. The liner should be designed in accordance with slabs-on-grade criteria for fabricated structures requiring watertightness.

Embankments

The minimum elevation of the top of the settled embankment shall be 1 foot (0.3 m) above the required storage volume for a waste storage pond without an auxiliary spillway, and 1 foot (0.3 m) above the design depth of flow in the auxiliary (emergency) spillway for a storage pond with an auxiliary spillway. This height shall be increased by the amount needed to ensure that the embankment top elevation will be maintained after settlement. This increase shall be not less than 5 percent.

The minimum embankment top width shall be as shown in Table 2. If the embankment top is to be used as a road, the minimum width shall be 16 feet (5.9 m) for one-way traffic and 26 feet (8 m) for two-way traffic. Guard rails or other safety measures shall be used where necessary, and provisions shall be made for protecting the auxiliary (emergency) spillway from damage.

Table 2. Embankment Top Width

Total Height of Embankment, feet (meters)	Minimum Top Width, feet (meters)
< 15 (4.6 m)	8 (2.4 m)
15 to <20 (4.6 to <6.1m)	10 (3.1 m)
20 to 25 (6.1 to 7.6 m)	12 (3.7 m)

The combined side slopes of the settled embankment shall be not less than 5 horizontal to 1 vertical (5:1), and neither slope shall be steeper than 2 horizontal to 1 vertical (2:1). All slopes must be designed to be stable. Where embankments are to be mowed, 3 horizontal to 1 vertical (3:1), or flatter, slopes are recommended.

Compaction of the embankment fill material shall be in accordance with the specified design requirements for compaction and moisture content.

Auxiliary (Emergency) Spillway

Auxiliary spillway requirements do not apply to waste storage ponds without drainage areas and with less than 3 feet (0.9 m) of storage above natural ground.

The EPA CAFO regulations restrict the use of auxiliary spillways on waste storage ponds for swine, veal, and poultry operations. These stricter regulations are to be used in place of the guidance given in this standard.

An auxiliary (emergency) spillway, combination of spillways, or additional storage shall be provided to protect the waste storage pond from overtopping when the design volume is filled and a 25-year, 24-hour storm event is exceeded. The crest of the auxiliary spillway shall be located at or above the top of the 25-year, 24-hour storm storage. The auxiliary spillway shall be designed to pass a 25-year, 24-hour storm while maintaining a minimum of 1 foot (0.3 m) of freeboard above the designed depth of flow in the auxiliary spillway.

The auxiliary spillway shall be placed in undisturbed soil when possible. When it must be placed in fill material, precautions shall be taken to ensure the integrity of the structure. Where a waste storage pond empties into another waste storage pond and the liquid level is positively controlled by an adequately sized overflow pipe, no auxiliary spillway is required for the primary waste storage pond.

Pipe auxiliary spillways shall be 6 inch (152 mm) minimum diameter and equipped with trash racks, antivortex devices, and antiseep collars as required in Virginia Conservation Practice Standard *Pond (Code 378)*. Pipes may be steel, concrete, aluminum, or PVC, as required in Virginia Conservation Practice Standard *Pond (Code 378)*.

Staff Gage

A staff gage or other permanent marker shall be placed in the waste storage pond to clearly indicate the maximum level of storage allowed to accumulate before emptying must be initiated. The marker shall indicate the level at which sufficient storage remains to contain the 25-year, 24-hour runoff and precipitation (or other required storm volume).

SPECIFIC CRITERIA FOR ALL FABRICATED STRUCTURES

Foundation

The foundations of fabricated waste storage facilities shall be proportioned to safely support all superimposed loads without excessive movement or settlement.

Where a non-uniform foundation cannot be avoided or where applied loads may create highly variable foundation loads, settlement should be calculated from site specific soil test data. Index tests of site soil may allow correlation with similar soils for which test data is available. If no test data is available, presumptive bearing strength values for assessing actual bearing pressures may be obtained from Table 3 or another nationally recognized building code. In using presumptive bearing values, adequate detailing and articulation shall be provided to avoid distressing movements in the structure.

Foundations consisting of bedrock with joints, fractures, or solution channels shall be treated or a separation distance provided consisting of a minimum of 1 foot (0.3 m) of impermeable soil between the floor slab and the bedrock or an alternative that will achieve equal protection.

Design Bottom Elevation

The design bottom elevation of the fabricated structure waste storage facility shall be no lower than the seasonal high water table unless hydrostatic and buoyant forces are taken into account during the design of the structure. Dry stack facilities with earth floors must be installed with the elevation of the top of the floor at least 2 feet (0.6 m) above the seasonal high water table.

Table 3. Presumptive Allowable Bearing Stress Values[1/]

Foundation Description	Allowable Stress
Crystalline Bedrock	12000 psf (575,000 Pa)
Sedimentary Rock	6000 psf (2285,00 Pa)
Sandy Gravel or Gravel	5000 psf (240,000 Pa)
Sand, Silty Sand, Clayey Sand, Silty Gravel, Clayey Gravel	3000psf (145,000 Pa)
Clay, Sandy Clay, Silty Clay, Clayey Silt	2000 psf (95,000 Pa)

[1/] Basic Building Code, 12th Edition, 1993, Building Officials and Code Administrators, Inc. (BOCA)

Design Storage Volume

In addition to the design volume, a minimum of 6 inches (150 mm) shall be provided for freeboard except for solid stacking fabricated structures. Solid stacking implies that the manure has a consistency that does not flow, but stays in place even during the wettest time of storage period. The design volume for solid stacking fabricated structures may exceed the height of the structure walls. The anticipated stacking angle of the manure must be considered in determining the required wall height.

Liquid Tightness

Applications such as tanks that require liquid tightness shall be designed and constructed in accordance with standard engineering and industry practices appropriate to the construction material used to achieve this objective.

Structural Loading

Waste storage structures shall be designed to withstand all anticipated loads including internal and external loads, hydrostatic uplift pressure, concentrated surface and impact loads, water pressure due to seasonal high water table, and frost or ice pressure, and load combinations in compliance with this standard and applicable local building codes.

The lateral earth pressures should be calculated from soil strength values determined from the results of appropriate soil tests. Lateral earth pressures can be calculated using the procedures in NRCS Technical Release (TR) - 74. If soil strength tests are not available, the presumptive lateral earth pressure values indicated in Table 4 shall be used.

Lateral earth pressures based upon equivalent fluid assumptions shall be assigned according to the structural stiffness or wall yielding as follows:

* **Rigid frame or restrained wall**. Use the values shown in Table 4 under the column "Frame Tanks", which gives pressures comparable to the at-rest condition.

* **Flexible or yielding wall**. Use the values shown in Table 4 under the column "Freestanding Wall", which gives pressures comparable to the active condition. Walls in this category are designed on the basis of gravity for stability or are designed as a cantilever having a base wall thickness to height of backfill ratio not more than 0.085.

Internal lateral pressure used for design shall be 65 lbs/ft^2 (3,120 Pa) where the stored waste is not protected from precipitation. A value of 60 lbs/ft^2 (2,880 Pa) may be used where the stored waste is protected from precipitation and will not become saturated. Lesser values may be used if supported by measurement of actual pressures of the waste to be stored. If heavy equipment will be operated near the wall, an additional two feet (0.6 m) of soil surcharge shall be considered in the wall analysis.

Tank covers shall be designed to withstand both dead and live loads. The live load values for covers contained in ASAE EP378.3, Floor and Suspended Loads on Agricultural Structure Due to Use, and in ASAE EP393.2, Manure Storages, shall be the minimum used. The actual axle load for tank wagons having more than a 2,000 gallon (7,600 l) capacity shall be used.

Table 4. Lateral Earth Pressure Values[1]

		Equivalent fluid pressure lb/ft^2/ft of depth (Pa/m)			
Soil		**Above seasonal high water table[2]**		**Below seasonal high water table[3]**	
Description[4]	**Unified Classification[4]**	**Free-standing walls**	**Frame tanks**	**Free-standing walls**	**Frame tanks**
Clean gravel, sand, or sand-gravel mixtures (maximum 5% fines)[5]	GP,GW,SP,SW	30 (4,700)	50 (7,900)	80 (12,500)	90 (14,100)
Gravel, sand, silt, and clay mixtures (less than 50% fines) Coarse sands with silt and/or clay (less than 50% fines)	All gravel/sand dual symbol classifications and GM,GC,SC,SM, SC-SM	35 (5,500)	60 (9,400)	80 (12,500)	100 (15,700)

Low plasticity silts and clays with some sand and/or gravel (50% or more Fines) Fine sands with silt and/or clay (less than 50% fines)	CL,ML,CL-ML,SC, SM,SC-SM	45 (7,100)	75 (11,800)	90 (14,100)	105 (16,500)
Low to medium plasticity silts and clays with little sand and/or gravel (50% or more fines)	CL,ML,CL-ML	65 (10,200)	85 (13,300)	95 (14,900)	110 (17,200)
High plasticity silts and clays (liquid limit more than 50)[6]	CH, MH	-	-	-	-

[1] For lightly compacted soils (85% to 90% maximum standard density.) Includes compaction by use of typical farm equipment.
[2] Also below seasonal high water table if adequate drainage is provided.
[3] Includes hydrostatic pressure.
[4] All definitions and procedures in accordance with ASTM D2488, D2487, and D653.
[5] Generally, only washed materials are in this category.
[6] Not recommended. Requires special design if used.

If the facility is to have a roof, wind and snow loads shall be as specified in ASAE EP288.5, Agricultural Building Snow and Wind Loads. Roof designs shall be certified by a PE. If the facility is to serve as part of a foundation or support for a building, the total load shall be considered in the structural design.

Structural Design

The structural design shall consider all items that will influence the performance of the structure, including loading assumptions, material properties, and construction quality. Design assumptions and construction requirements shall be indicated on the plans.

Tanks may be designed with or without covers. Covers, beams, or braces that are integral to structural performance must be indicated on the construction drawings. The openings in covered holding tanks shall be designed to accommodate equipment for loading, agitating, and emptying, and shall have grills or secure covers for safety, odor, and vector control.

All structures shall be underlain by free draining materials or shall have a footing located below the anticipated frost depth. Fabricated structures shall be designed according to the criteria in the following references, as appropriate:

Steel. "Manual of Steel Construction", American Institute of Steel Construction.

Timber. "National Design Specifications for Wood Construction", American Forest and Paper Association. All lumber in contact with the ground or waste shall be pressure-treated in accordance ASTM D1760.

Concrete. "Building Code Requirements for Reinforced Concrete, ACI 318", American Concrete Institute.

Masonry. "Building Code Requirements for Masonry Structures, ACI 530", American Concrete Institute.

Concrete Slabs on Grade

Slab design shall consider the required performance and the critical applied loads along with both the subgrade material and material resistance of the concrete slab. Where applied point loads are minimal and liquid-tightness is not required, such as barnyard and feedlot slabs subject only to precipitation, and the subgrade is uniform and dense, the minimum slab thickness shall be 4 inches (100 mm) with a minimum joint spacing of 10 feet (3.1 m). Joint spacing can be increased if steel reinforcing is added based on subgrade drag theory.

For applications where liquid-tightness is

required, such as for floor slabs of storage tanks, the minimum thickness for uniform foundations shall be 5 inches (125 mm) and shall contain distributed reinforcing steel. The required area of such reinforcing steel shall be based on subgrade drag theory as discussed in industry guidelines such as American Concrete Institute, ACI 360, Design of Slabs-on-Grade.

When heavy equipment loads are to be resisted and/or where a non-uniform foundation cannot be avoided, an appropriate design procedure as described in ACI 360 shall be used.

CONSIDERATIONS

SPONTANEOUS COMBUSTION

Certain types of dry wastes, such as poultry litter, are susceptible to spontaneous combustion. To minimize this potential, poultry litter in a stacking facility should have less than 40 percent moisture, and dry litter and moist litter should not be layered. In addition, the height of the litter stack shall not exceed 7 feet (2.1 m), with litter-to-wood contact limited to 3 feet (0.9 m).

SOLIDS SEPARATION

To minimize frequency of solids removal from waste storage ponds, route polluted runoff through vegetative filter strips, low-gradient channels, or debris basins to remove readily settleable solids. Settling facilities should have adequate capacity to store settled solids for a time period based on climate, equipment, clean out frequency, and method of disposal. If animal manure, such as from dairy cows, is flushed to a storage pond, a solids separator may be provided for removing fibrous solids to facilitate pumping and irrigation. Solid separators, debris basins, etc., shall be designed to prevent seepage to the groundwater.

WATER QUANTITY

Waste storage facilities will have an effect on the water budget. The effect will be dependent upon the size of the waste storage facility. The waste storage facility will cause an increase in evaporation and a decrease in downstream runoff where drainage is designed to enter the facility.

The waste storage facility will not increase water demand at the site.

WATER QUALITY

The waste storage facility should have an overall positive impact on water quality by storing animal waste and polluted runoff until it can be safely applied to the land. Water quality can be adversely impacted during initial construction due to erosion of the site but will be minimal using proper construction pollution prevention measures.

OTHER CONSIDERATIONS

Non-polluted runoff should be excluded from the waste storage facility to the fullest extent possible, except where its storage is advantageous to the operation of the agricultural waste management system.

Due consideration should be given to economics, the overall waste management system plan, safety and health factors.

Considerations for Minimizing the Potential for and Impacts of a Sudden Breach of Embankment or Accidental Release

Although waste storage facilities are designed as low hazard structures, a failure of the structure or other accidental release of manure may adversely affect the following areas:

- Surface water bodies such as perennial streams, lakes, wetlands, or estuaries
- Critical habitat for threatened and endangered species
- Farmsteads or other areas of habitation
- Off-farm property, including historical and/or archeological sites or structures

To minimize the potential for or the consequences of sudden breach of embankments, consideration should be given to incorporating one or more of the following components into the design:

- An auxiliary (emergency) spillway
- Additional freeboard
- Wet year rather than normal year precipitation
- Reinforced embankment - such as additional top width and flattened and/or armored downstream side slopes
- Secondary containment

To minimize the potential for accidental release of gravity outlets from the required volume, these components may be included in the design:

- Outlet gate locks or locked gate housing
- Secondary containment
- Another means of emptying the required volume

Considerations for Minimizing the Potential of Waste Storage Pond Liner Failure

Sites with the conditions listed below should be avoided unless no reasonable alternative exists:

- Any underlying aquifer is at a shallow depth and not confined
- The vadose zone is rock
- The aquifer is a domestic water supply or ecologically vital water supply
- The site is located in an area of carbonate rock (limestone or dolomite)

Under those circumstances, consideration should be given to providing an additional measure of safety from pond seepage when any of the potential impact categories listed above may be significantly affected.

Possible additional safety measures include:

1. A clay liner designed in accordance with procedures of AWMFH Appendix 10D with a thickness and coefficient of permeability so that specific discharge is less than 1×10^{6} cm/sec.
2. A flexible membrane liner over a clay liner.

3. A geosynthetic clay liner (GCL) flexible membrane liner.

4. A concrete liner designed in accordance with slabs on grade criteria for fabricated structures requiring water tightness.

Consideration for Minimizing the Impact of Odors

Use of an anaerobic lagoon, Virginia Conservation Practice Standard *Waste Treatment Lagoon (Code 359)*, instead of a waste storage pond should be considered for sites located in rural areas where odors are a concern. This should be especially considered where odors would affect neighboring farms having enterprises that do not cause odors and/or neighbors who earn a living off-farm. The recommended loading rate for anaerobic lagoons at sites where odors must be minimized is one-half the values given in AWMFH Figure 10-22.

For odor control on sites located near urban areas, the following alternatives should be considered:

1. Covering the storage facility with a suitable cover

2. Using naturally aerated or mechanically aerated lagoons

3. Using composting in conjunction with a solid waste system rather than a liquid or slurry system

4. Using a methane digester and capture system

PLANS AND SPECIFICATIONS

Plans and specifications shall be prepared in accordance with the criteria of this standard and shall describe the requirements for applying the practice to achieve its intended use. Engineering plans, specifications, and reports shall include but not be limited to the following:

DESIGN DATA

1. Detailed soils, foundation, and site investigation report with supporting data
2. Field survey
3. Plan view of system layout

4. Waste storage volume calculations for a storage period in agreement with a current Nutrient Management Plan

5. Complete design computations and drawings to describe the horizontal and vertical position of structures and their relation to adjacent physical features. The distance to the nearest area or public use or residence of anyone other than the owner or his tenant shall be recorded. Include required sealing treatments or liners.

6. Material quantities

7. Structural details of all components

8. References and certifications of components supplied by others (pumps, commercial liner specifications, truss manufacturer certification, etc.)

9. Drainage/grading plan if needed

10. Special safety requirements

11. Temporary erosion control measures during construction

12. Operation and maintenance requirements

13. A completed Waste Management System Plan for the owner's total livestock operation that addresses types and numbers of animals, including Emergency Action Plan

14. Environmental Evaluation Form VA-EE-1

CHECK DATA

1. As built drawings showing changes from the design

2. As built storage volume

3. Component certifications; i.e., truss rafters, holding pond liner, existing components of new waste system, etc.

4. NRCS or PE storage facility certification

5. Statement that disturbed areas have been stabilized and fencing is adequate

OPERATION AND MAINTENANCE

Operation and maintenance requirements shall be developed that are consistent with the purposes of the practice, its intended life, safety requirements, and the criteria for its design. The waste storage facility should be inspected periodically to ensure that all components are operating as planned.

The O&M requirements shall contain the operational plan for emptying the storage facility. It shall include maximum operating levels of the waste storage facility, clean-out intervals, operation requirements of structural components, etc. The O&M requirements shall include the statement that waste shall be removed from storage and utilized at locations, times, rates, and volumes in accordance with Virginia Conservation Practice Standards *Nutrient Management (Code 590)* or *Waste Utilization (Code 633).* In addition, the O&M requirements for waste ponds shall include the requirement that following storms, waste shall be removed at the earliest environmentally safe opportunity to ensure that sufficient capacity is available to accommodate subsequent storms.

Waste storage ponds are to be routinely agitated and pumped according to an operation and maintenance schedule to prevent the accumulation of excessive sludges.

The O&M requirements must describe protection, maintenance, and repair of linings.

The O&M requirements for stacking facilities shall state that the structure be inspected at least twice each year when the facility is empty. Any wooden parts, hardware, or other replaceable parts which are damaged or show excessive wear or decay shall be replaced. Roof structures should be examined for structural integrity. Walls of dry stacks that are constructed with lumber may need replacing during the life of the structure.

The waste storage facility shall be operated so as to maintain the storage capacity for the 25-year, 24-hour storm.

The embankment and other vegetated areas shall be mowed and fertilized to maintain a protective vegetative cover. Vegetation shall be clipped a minimum two times each year on the pond embankments.

EMERGENCY ACTION PLAN

An Emergency Action Plan shall be prepared for each facility. The plan will outline specific steps to be followed in case of an emergency such as an overflow, breach, leakage, fire, need for emergency land application, etc. As a minimum, it will contain the following items for the owner/operator to complete in the event of an emergency:

1. Call the Department of Emergency Services, Emergency Operations Center (1-800-468-8892) to report the problem. Give the name of the facility and the location.

2. Call 911 or the Sheriff's Department (include phone number) if there is danger to downstream property such as residences, roads, or water supplies.

3. Contact the contractor of choice to begin emergency repairs to minimize off-site damage. Include name and phone numbers.

4. Contact the technical specialist who certified the lagoon (NRCS, Consulting Engineer, etc.). Include the name and phone number. If this specialist is no longer working or unavailable, contact one who has design approval.

A copy of the plan with telephone numbers must be available at each site. It should be posted in a readily available site.

REFERENCES

1. ACI 318, 360, 530.

2. ASTM D653, D698, D2488, D1760

3. ASAE Specifications: EP378.3, EP393.2, EP288.5, S288.

4. Agricultural Waste Management Field Handbook, Chapters 7 and 10, NEH Part 651

5. Basic Building Code, 12th Edition, 1993, Building Officials and Code Administrators,

Inc. (BOCA).

6. "Manual of Steel Construction", American Institute of Steel Construction.

7. "National Design Specifications for Wood Construction", American Forest and Paper Association.

8. National Engineering Manual, Part 520.

9. Virginia NRCS Field Office Technical Guide.

10. NRCS Technical Release, TR-74.

11. NRCS Field Book for Describing and Sampling Soils.

NATURAL RESOURCES CONSERVATION SERVICE

VIRGINIA CONSERVATION PRACTICE STANDARD

WASTE STORAGE FACILITY

Approved Practice Narratives

(No.)

CODE 313

313 D1 Waste Storage Facility: A permanent earthen storage facility designed to contain temporary storage of liquid and slurry animal waste and contaminated runoff, to be installed at the approximate location shown on the Conservation Plan map, and maintained as a component of the Waste Management System. The design, construction specifications, and operation and maintenance guidelines will be provided.

313 D2 Waste Storage Facility: A permanent structure designed to contain temporary storage of liquid and slurry animal waste and contaminated runoff, to be installed at the approximate location shown on the Conservation Plan map, and maintained as a component of the Waste Management System. The design, construction specifications, and operation and maintenance guidelines will be provided.

313 D3 Waste Storage Facility: A permanent structure designed to contain temporary storage of solid animal waste, to be installed at the approximate location shown on the Conservation Plan map, and maintained as a component of the Waste Management System. The design, construction specifications, and operation and maintenance guidelines will be provided.

To file a complaint of discrimination, write USDA, Director, Office of Civil Rights, Room 326 W. Whitten Building, 14th and Independence Avenue, SW, Washington, DC 20250-9410 or call (202) 720-5964 (voice or TDD). USDA is an equal opportunity provider and employer.